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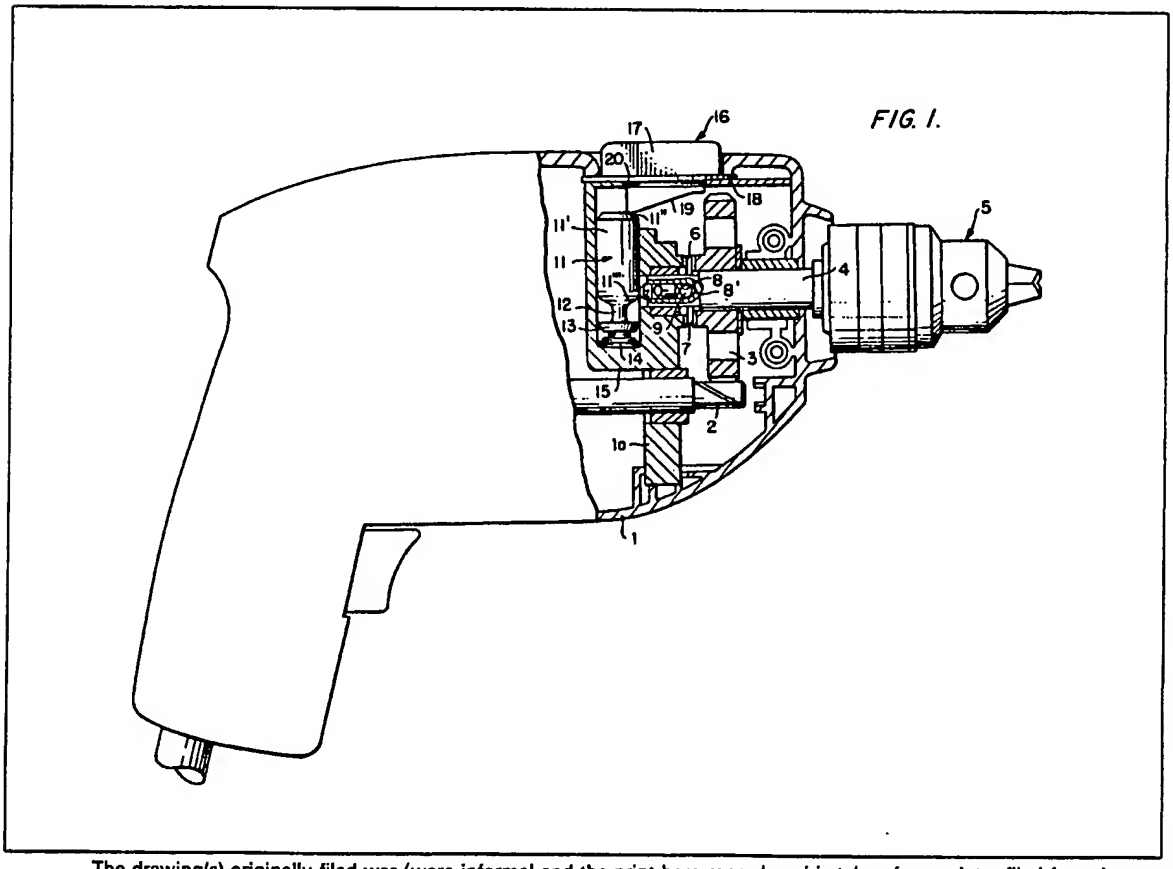
(54) **A power drill**

(57) The invention relates to a power drill which is optionally operable in a smooth drilling mode of operation or in a hammer-drilling mode of operation and the drill has a control device for selection of the mode of operation of the drill comprises a displaceable selector member (16) having a cam surface (19) for enabling displacement of a control member (11) whichis acted upon by the inner end of the axially displaceable rotary tool spindle (4) driven by drive means (gear wheel 3) engaged by drive spindle (2) of an electric motor (not shown) with said control member (11) having a portion (11′) of one diameter which locates said spindle (4) in the smooth-drilling mode position and a portion (12) of reduced diameter which permits displacement of said spindle (4) into the hammer-drilling mode position; said control member (11) being biassed by a spring (14) and displaceable by rotation of selector knob (16).



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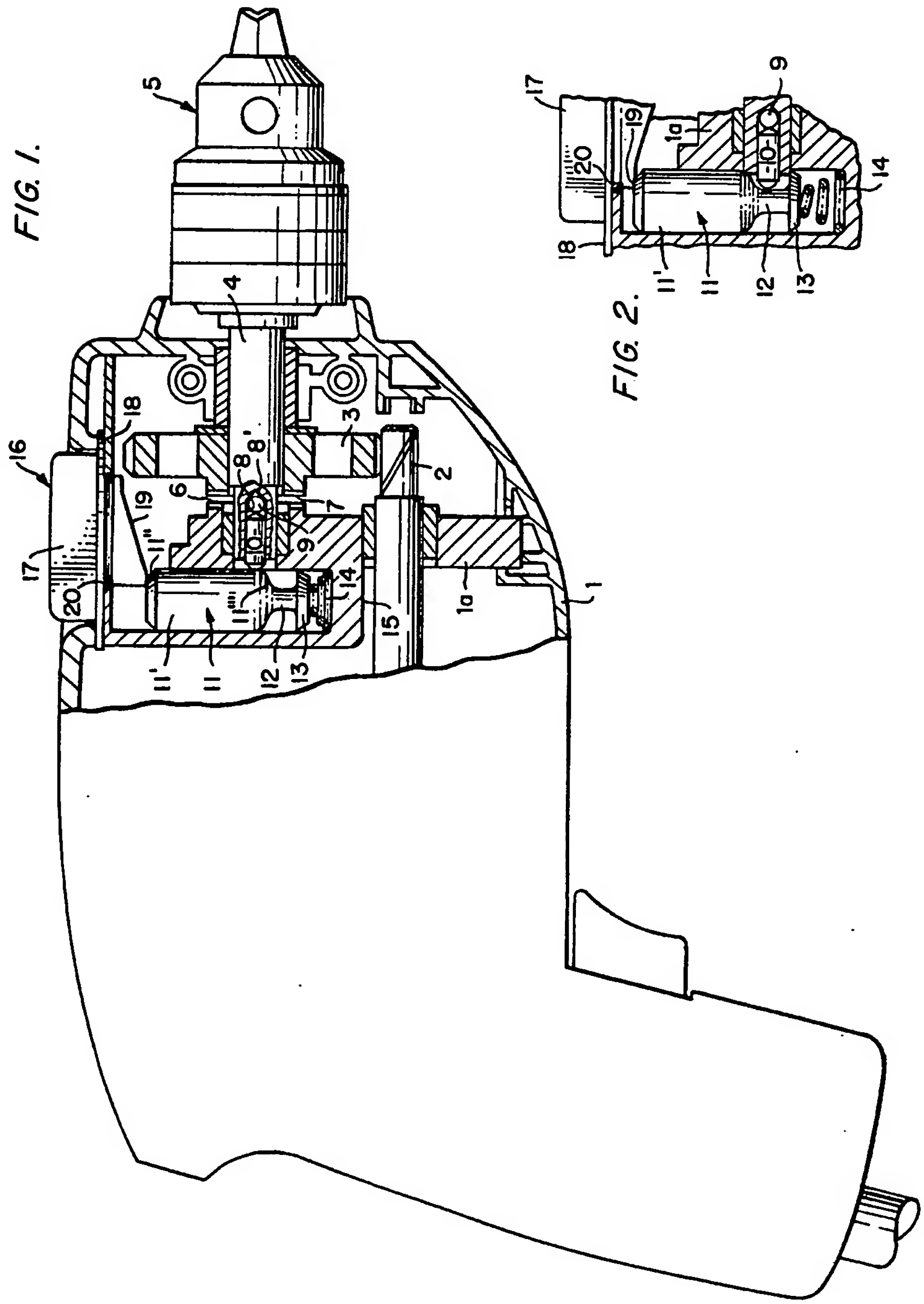

FIG. 1.

FIG. 2.

SPECIFICATION

A power drill

The present invention relates to an improved power drill of the type being optionally operable in a smooth-drilling mode of operation or a hammer- or percussion-drilling mode of operation and, more particularly, to a control device or means for selection of the mode of operation of such a drill.

Various proposals have been made for permitting selection of the mode of operation of a drill from normal operation to percussive or hammer operation although the present invention provides such a mode selection device in a drill whichis economic to manufacture, reliable in operation and simple to assemble whilst at the same time readily ensuring it assumes one of the two operative modes.

According to the present invention a power drill with an optional percussion drilling mode of operation, includes a housing, drive means, an axially displaceable rotary tool spindle driven by said drive means and having an outer end with means for receiving a drill bit and an inner end, a stationary surface with notches or ratchet teeth extending around said output spindle and a rotary surface with notches or ratchet teeth carried by said spindle with said two surfaces being interengageable, and control means for permitting axial displacement of said spindle in one direction into the percussion mode with said ratchet teeth being interengaged, and for effecting axial displacement of said spindle in the opposite direction into the non-percussion drilling mode; characterised by the feature that said control means comprise a displaceable selector member having a cam surface for enabling displacement of a control member which is acted upon by the inner end of said spindle with said control member having a portion of one diameter which locates said spindle in the smooth-drilling mode position and a portion of reduced diameter relative to said one diameter portion and which reduced diameter portion permits displacement of said spindle into the percussion-drilling mode position, and wherein optional displacement of said selector member enables displacement of said control member so that the drill may function in either of the two modes of drilling operation.

The displaceable control member which receives the main thrust forces of the tool spindle preferably comprises an elongate member, such as a cylinder, having a portion of reduced diameter with the surface between the normal diameter and the reduced diameter preferably being sloped or concavely recessed to facilitate displacement of the end of the spindle from one diameter portion to the other. Preferably an enlarged or flange portion will be provided at the end of the reduced diameter portion remote from the said one or "normal" diameter portion of the control member to act as a stop for the end of said spindle. A compression spring or other bias means will preferably act on said flange so as to bias said control member in one direction. It is immaterial whether the spring biasses the control member so as to normally assume the normal or percussion mode of operation and various options will now become apparent to persons skilled in the art. The control member is restricted in its movement by the cam surface of the selector member which acts also to restrain displacement of the control member under the bias of said spring.

The selector member will preferably comprise a manually operable knob or control lever having a portion defining the cam surface which acts against an end of said control member which is that normally remote from the earlier-mentioned flange or stop portion and at the end remote from said spring. The cam surface will preferably be a peripheral circular ridge or a disc surface and will have portions of different height so that, upon displacement of said selector member, the control member will be displaced so that the end of said spindle abuts either against the portion of normal diameter or the portion of reduced diameter. It is possible that a control member with more than two portions of different operative diameters may be provided for displacement of the spindle for effecting control operations other than drilling mode selection, e.g. for effecting speed changes via different gear arrangements, and in which case the cam surfaces of the selector member will have to be modified appropriately. However, the following description will be confined to a device for mode selection in drills which effects only the mode selection. It is, of course, possible for speed changing to be effected by other means separate from the device of the present invention.

Preferably the end of the output spindle which acts against said control member will have bearing means for reducing the frictional forces. In one embodiment such bearing means comprise a cylindrical blind bore formed in said spindle with a conical or radiussed surface at the blind end thereof to receive a ball-bearing with minimal friction. The blind bore also receives a cylindrical thrust pin having domed or sperical end portions one of which end portions acts against the ball-bearing with minimal friction whilst the other acts against the surfaces of said control member. The lands between the surface of the control member of normal diameter and the surface of the control member of reduced diameter are radiussed or curved so as to ensure a smooth and ready transition from one mode of operation to the other by the end of said cylinder bearing thereagainst.

It will be appreciated that the device according to the present invention includes two

distinct members one of which receives thrust forces from the tool spindle and is preferably elongate and displaceable along its longitudinal axis to effect change of mode of operation whilst the other member, the selector member with the cam surface will be angularly displaceable about its axis of rotation which is preferably offset from the longitudinal axis of the control member. Any suitable biassing means may be provided to urge the control member against the selector member.

The invention will be described further, by way of example, with reference to the accompanying drawings, in which:—

Figure 1 is a schematic side elevation of a portable electric drill with a portion of the housing broken away and the interior sectioned to illustrate the mode selection device or control means of the invention;

Figure 2 is a fragmentary detail of Fig. 1 illustrating the alternative position of the selector member and control member permitting the drill to operate in the percussion or hammer mode.

The drill according to the present invention comprises a housing 1 with supporting parts 1*a* and containing an electric motor as drive means (not shown) having a drive spindle 2 operatively engaging a toothed gear wheel 3 mounted on a rotary tool output spindle 4 so as to drive such upon energisation of said electric motor. The drive spindle 4 carries a chuck 5 at one end for receiving a drill bit (not shown) and is mounted in suitable bearings as illustrated to permit limited axial and rotary displacement.

One set of stationary ratchet teeth 6 are mounted within the housing 1 extending around the spindle 4 whilst an end face of the gear wheel 3 has ratchet teeth 7 formed thereon which teeth are interengageable with the ratchet teeth 6 in the hammer or percussion mode of operation of the drill. The end of the spindle 4 has a blind bore 8 formed therein with a conical surface 8 at the end thereof on which rolls a ball-bearing 9 with minimal frictional engagement. A cylindrical pin 10 is rotatably located within bore 8 and has domed or otherwise curved end faces —one of which engages the surface of the ball-bearing 9 whilst the other is engageable against the surfaces of a control member 11.

Control member 11 is a cylindrical member having a portion 12 of reduced diameter 12 and a stop or flange portion 13. The surfaces between the larger diameter portion of member 11 and the reduced diameter portion 12 are suitably curved or concave so as to permit smooth displacement of said pin 10 from the larger diameter to the smaller diameter (and *vice versa*) upon axial displacement of the control member 11.

A coiled compression spring 14 is provided to act between a stationary portion 15 of the supporting part 1*a* and the flange portion 13 of the control member 11 and, in the embodiment illustrated, biasses the control member 11 upwardly so as to present the portion 12 of reduced diameter adjacent the pin 10 in the upwardly displaced position. Control member 11 is restrained from displacement by the spring 14 by means of a selector member 16 which comprises a knob portion 17, a peripheral, locating flange portion 18 and a cam surface 19 integrally formed therewith—preferably of plastics material—with suitable sealing means 20 located within grooves formed in the selector member 17 and supporting part 1*a*. The cam 19 provides an operative peripheral cam surface which is arranged and adapted such that upon rotation of the selector knob 16, the control member 11 is acted upon by the cam surface 19 so as to cause such to be displaced from a position (Fig. 1) wherein the pin 10 abuts against the larger cylindrical surface 11′ of said earlier mentioned one diameter in the normal, smooth drilling mode into a position (Fig. 2) wherein the end of pin 10 is displaced following axial displacement of spindle 4 so as to rest against the portion 12 of reduced diameter (and vice versa). The spring member 14 urges the control member 11 against the cam surface 19 so that rotation of knob 17 from one selective position to the other achieves the desired mode selection. The edges 11′ of the end of the control member 11 are suitably rounded or bevelled to avoid wear and to facilitate operation and the transitional region 11″′ between the portion of larger diameter of the control member 11 and the portion 12 of reduced diameter is suitably radiussed or concaved to facilitate sliding movement of the control member 11 with the rounded end surface of thrust pin 10 and facilitate mode changes.

CLAIMS

1. A power drill with an optional percussion drilling mode of operation, includes a housing, drive means, an axially displaceable rotary tool spindle driven by said drive means and having an outer end with means for receiving a drill bit and an inner end, a stationary surface with notches or ratchet teeth extending around said output spindle and a rotary suface with notches or ratchet teeth carried by said spindle with said two surfaces being interengageable, and control means for permitting axial displacement of said spindle in one direction into the percussion mode with said ratchet teeth being interengaged, and for effecting axial displacement of said spindle in the opposite direction into the non-percussion drilling mode, characterised by the feature that said control means comprise a displaceable selector member having a cam surface for enabling displacement of a control member which is acted upon by the inner end of said spindle with said control

member having a portion of one diameter which locates said spindle in the smooth-drilling mode position and a portion of reduced diameter relative to said one diameter portion and which reduced diameter portion permits displacement of said spindle into the percussion-drilling mode position, and wherein optional displacement of said selector member enables displacement of said control member so that the drill may function in either of the two modes of drilling operation.

2. A drill as claimed in claim 1, in which the control member is an elongate member axially displaceable along its longitudinal axis.

3. A drill as claimed in claim 2, in which the control member is cylindrical.

4. A drill as claimed in any of claims 1 to 3, in which the transitional surface between the portion of one diameter and that of reduced diameter is inclined or curved to facilitate displacement of the end of said spindle from one diameter portion to the other.

5. A drill as claimed in any of claims 1 to 4, in which a flange or stop portion is provided on the control member at the end of the reduced diameter portion remote from said one diameter portion for being acted upon by said biassing means and/or for confining the end of said spindle in the percussion mode portion.

6. A drill as claimed in any of claims 1 to 5, in which the selector member is a manually operable knob rotatably mounted in the housing and has a circular cam surface which slidingly engages said end of the portion of one diameter of the control member to restrict movement thereof under the action of said bias means.

7. A drill as claimed in any of claims 1 to 6, in which bearing means are provided at the end of said tool spindle to engage said control member and reduce frictional forces.

8. A drill as claimed in claim 7, in which said bearing means comprise a blind bore in the end of said tool spindle and extending axially therealong, and a thrust pin with rounded ends located to be rotatable within said bore and extending therefrom to engage said control member.

9. A drill as claimed in claim 8, in which a ball bearing is located within said blind bore between the end of said thrust pin and the end of said bore which end is radiussed or conical so as to reduce frictional forces.

10. A drill as claimed in claim 2, in which the selector member is an angularly displaceable member having an axis of rotation which is spaced from and substantially parallel to the longitudinal axis of said control member

11. A portable drill substantially as herein described with reference to and as illustrated in the accompanying drawings.

CLAIMS (28 Oct 1982)

1. A power drill with an optional percussion drilling mode of operation, includes a housing, drive means, an axially displaceable rotary tool spindle driven by said drive means and having an outer end with means for receiving a drill bit and an inner end, a stationary surface with notches or ratchet teeth extending around said output spindle and a rotary surface with notches or ratchet teeth carried by said spindle with said two surfaces being interengageable, and control means for permitting axial displacement of said spindle in one direction into the percussion mode with said ratchet teeth being interengaged, and for effecting axial displacement of said spindle in the opposite direction into the non-percussion drilling mode, characterised by said control means comprising a displaceable selector member having a cam surface for enabling displacement of a control member which is acted upon by the inner end of said spindle, said control member having a portion of one diameter which locates said spindle in the smooth-drilling mode position and a portion of reduced diameter relative to said one diameter portion, said reduced diameter portion permitting displacement of said spindle into the percussion-drilling mode position, and bias means for biasing said control member towards said cam surface, wherein optional displacement of said selector member enables displacement of said control member so that the drill may function in either of the two modes of drilling operation.

2. A drill as claimed in claim 1, in which the control member is an elongate member axially displaceable along its longitudinal axis.

3. A drill as claimed in claim 2, in which the control member is cylindrical.

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